

STORM WATER MANAGEMENT PLAN

**Project No. TPM 20929
Environmental Log No. ER 05-02-011**

**Property owned by
John and Mary Caney
on
Cole Grade Road**

**Prepared By
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8555 Aero Drive
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**For
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**Revised: ~~May 26, 2005~~
September 29, 2005**

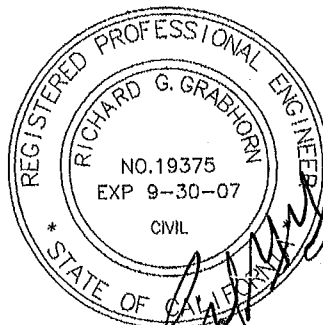


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INTRODUCTION

The Stormwater Management Plan (SWMP) requirement is required under the County of San Diego Watershed Protection, Stormwater Management, and Discharge Control Ordinance (section 67.817). The purpose of this SWMP is to address the water quality impacts from the proposed improvements on the property owned by John and Mary Caney on Cole Grade Road in Valley Center, (the Project). Best Management Practices (BMPs) will be utilized to provide a long-term solution to water quality. This SWMP is also intended to ensure the effectiveness of the BMPs through proper maintenance that is based on long-term fiscal planning. The SWMP is subject to revisions as needed by the engineer.

1.0 PROJECT DESCRIPTION

The Project is located on the east side of Cole Grade Road north of Miller Road and south of Cane Road, in Valley Center, in the County of San Diego (See Attachment 1). The project is approximately 460 feet north of Miller Road. This project will consist of grading and private road improvements for two residential lots.

1.1 Topography and Land Use

The project area is characterized by moderately sloping land and is currently utilized as an avocado grove. The project is surrounded on all sides by low density residential development. All storm flows are conveyed away from the project by an existing 18" storm drain crossing under Cole Grade Road.

1.2 Hydrologic Unit Contribution

The project is located in the San Luis Rey Hydrologic Unit (903.12), more particularly in the Bonsall Hydrologic Sub Area of the Lower San Luis Hydrologic Area. The project drains westerly toward the San Luis Rey River. The storm flows from this project will discharge to an existing 18" storm drain crossing under Cole Grade Road and will be conveyed in a series of natural channels approximately 11 miles to the San Luis Rey River. The runoff flow rates in the developed condition will be slightly lower than in the existing condition due to the introduction of flat pad areas resulting in longer times of concentration. Since the project is only 0.0017 percent of the 558 square mile watershed, construction related and long-term impacts associated with the project are expected to be negligible.

2 WATER QUALITY ENVIRONMENT

2.1 Beneficial Uses

The beneficial uses for the hydrologic unit are included in Table 1.1.

Table 1.1
Beneficial Uses
San Luis Rey Hydrological Sub-Area (903.12)

Beneficial Uses	Inland Surface Waters	Coastal Waters	Reservoirs and Lakes	Ground Water
Municipal and Domestic Supply	X		X	X
Agricultural Supply	X		X	X
Industrial Service Supply	X		X	X
Industrial Process Supply			X	X
Hydropower Generation	X		X	
Navigation		X		
Freshwater Replenishment	X		X	X
Contact Water Recreation	X	X	X	
Non-Contact Water Recreation	X	X	X	
Commercial & Sport Fishing		X		
Biological Habitats of Special Significance		X		
Warm Freshwater Habitat	X		X	
Coldwater Freshwater Habitat	X			
Wildlife Habitat	X	X	X	
Rare, Threatened or Endangered Species	X	X	X	
Marine Habitat		X		
Migration of Aquatic Organisms		X		
Aquaculture		X		
Shellfish Harvesting		X		
Spawning, Reproduction and/or Early Development		X		

The reader is directed to the Water Quality Control Plan for the San Diego River Basin for more detailed descriptions of the above beneficial uses.

2.2 303(d) Status

According to the California 1998 303d list published by the San Diego Regional Water Quality Control Board, the Pacific Ocean at the mouth of the San Luis Rey River is the only impaired water body downstream of the project area where coliform bacteria is the only constituent of concern. The Pacific Ocean is approximately 26 miles downstream of the project.

3 CHARACTERIZATION OF PROJECT RUNOFF

3.1 Existing and Post-Construction Drainage

The proposed project will not significantly alter drainage patterns on the site. The Stormwater discharge points will have a minor change in contributing area (0.35 acres) from existing conditions. The impervious area will increase by 0.69 acres as a result of the project development. This change in land use will increase the composite runoff coefficient, of the project, from $C=0.31$ to $C=0.37$. However, the peak flow rate will decrease from 32.18 cfs under existing conditions to 29.90 cfs under the proposed condition for the total basin contributing to the project outfall, (an existing 18" storm drain pipe crossing under Cole Grade Road). The peak flow rate is decreased due to the introduction of flat pad areas resulting in longer times of concentration, and to a lesser extent by the redirection of 0.35 acres to the outfall at the southeast corner of the property.

A detailed description of the drainage patterns and flows are discussed in the Drainage Report. The preliminary design of this system is included in the BMP map. Summaries of the post-construction water quality flows are included in Table 3.1. The flows were developed using the 85th Percentile Precipitation map developed by the County, which was obtained from the website <http://www.co.san-diego.ca.us/dpw/land/flood.htm>. The water quality intensity is 0.92 in/hr, and the 100 year intensity is 4.26 in/hr.

Table 3.1 Post-Construction Water Quality Flows

Outfall	Tributary Area (acres)	Q ₁₀₀ (cfs)	Q _{wq} (cfs)
A	19.30	29.9	6.57
B	1.42	2.18	0.47

Outfall "A" is at the existing 18" storm drain crossing under Cole Grade Road.

Outfall "B" is surface flow at the south east corner of the project.

3.2 Post-Construction Expected Discharges

There are no sampling data available for the existing site condition. In addition, the project is not expected to generate significant amounts of non-visible pollutants. However, the following constituents are commonly found on similar developments and could affect water quality:

- Sediment discharge due to construction activities and post-construction areas left bare.
- Nutrients from fertilizers
- Trash and debris deposited in drain inlets.
- Hydrocarbons from paved areas.
- Pesticides from landscaping and home use.
- Bacteria and Viruses
- Oil and Grease
- Oxygen demanding substances

3.3 Soil Characteristics

The project area consists of soil group C and D. The project will not have slopes steeper than 2:1. All slopes will include slope protection for construction and post-construction.

(Note: Information regarding soil conditions is also available in the Soil Survey, San Diego Area, California, US Department of Agriculture, 1973.)

4.0 MITIGATION MEASURES TO PROTECT WATER QUALITY

To address water quality for the project, BMPs will be implemented during construction and post-construction.

4.1 Construction BMPs

A detailed description of the construction BMPs will be developed during the Grading Plan and Improvement Plan Engineering. Since the project is in the preliminary development phase only a listing of potential types of temporary BMPs are available. This includes the following:

- Silt Fence
- Gravel Bag Berm
- Material Delivery and Storage
- Vehicle and Equipment Maintenance
- Fiber Rolls
- Storm Drain Inlet Protection
- Stabilized Construction Entrance/Exit
- Solid Waste Management

Construction BMPs for this project will be selected, constructed, and maintained so as to comply with all applicable ordinances and guidance documents.

4.2 Post-construction BMPs

Pollutants of concern as noted in section 3 will be addressed through three types of BMPs. These types of BMPs are site design, source control and treatment control.

4.2.1 Site Design BMPs

The project is designed to minimize the use of impervious areas. Only 0.69 acres of impervious area will be added to the project. Streets have been designed to meet the minimum widths. Landscaping of the slopes and common areas are incorporated into the plans. The landscaping will consist of both native and non-native plants. The goal is to achieve plant establishment expeditiously to reduce erosion. The irrigation system for these landscaped areas will be monitored to reduce over irrigation. Also, riprap will be placed at storm drain outfalls to reduce velocities.

4.2.2 Source Control BMPs

Source control BMPs will consist of measures to prevent polluted runoff. This program will include an educational component directed at each homeowner. The homeowners will receive a set of brochures developed by the County's Environmental Health Department. These will include the following:

- Stormwater Runoff Pollution Fact Sheet;
- Stormwater Runoff Pollution Prevention Tips for Homeowners;
- Stormwater Pollution Prevention Yard Work (Landscaping, Gardening, Pest Control);
- Stormwater Pollution Prevention Pet Waste; and
- Stormwater BMP Swimming Pool and Spa Cleaning.

4.2.3 Treatment Control BMPs

The following treatment control BMPs will be implemented to address water quality:

- Bio-Filters

Placements of the BMPs are noted on the project plan (Attachment C).

4.2.3.1 Bio-Filters

Bio-filtration swales are vegetated channels that receive directed flow and convey storm water. Bio-filtration strips, also known as vegetated buffer strips, are vegetated sections of land over which storm water flows as overland sheet flow. A schematic illustration of bio-filter is shown in Figure 3.3.1.

Pollutants are removed by filtration through the grass, sedimentation, adsorption to soil particles, and infiltration through the soil. Swales and strips are mainly effective at removing debris and solid particles, although some dissolved constituents are removed by adsorption onto the soil.

4.2.3.1.1 Appropriate Applications and Siting Constraints:

Swales and strips should be considered wherever site conditions and climate allow vegetation to be established and where flow velocities are not high enough to cause scour. Even where strips cannot be sited to accept directed sheet flow, vegetated areas provide treatment of rainfall and reduce the overall impervious surface.

FACTORS AFFECTING PRELIMINARY DESIGN:

Swales have two design goals: 1) maximize treatment, 2) provide adequate hydraulic function for flood routing, adequate drainage and scour prevention. Treatment is maximized by designing the flow of water through the swale to be as shallow and long as site constraints allow. No minimum dimensions are required for treatment purposes, as this could exclude swales from consideration at some sites. Swales should also be sized as a conveyance system calculated according to County procedures for flood routing and scour.

To maximize treatment efficiency, strips should be designed to be as long (in the direction of flow) and as flat as the site will allow. No minimum lengths or maximum slopes are required for treatment purposes. The area to be used for the strip should be free of gullies or rills that can concentrate overland flow and cause erosion.

Vegetation mixes appropriate for various climates and locations will be developed by District landscape staff. Table 3.3.1 summarizes preliminary design factors for bio-filtration.

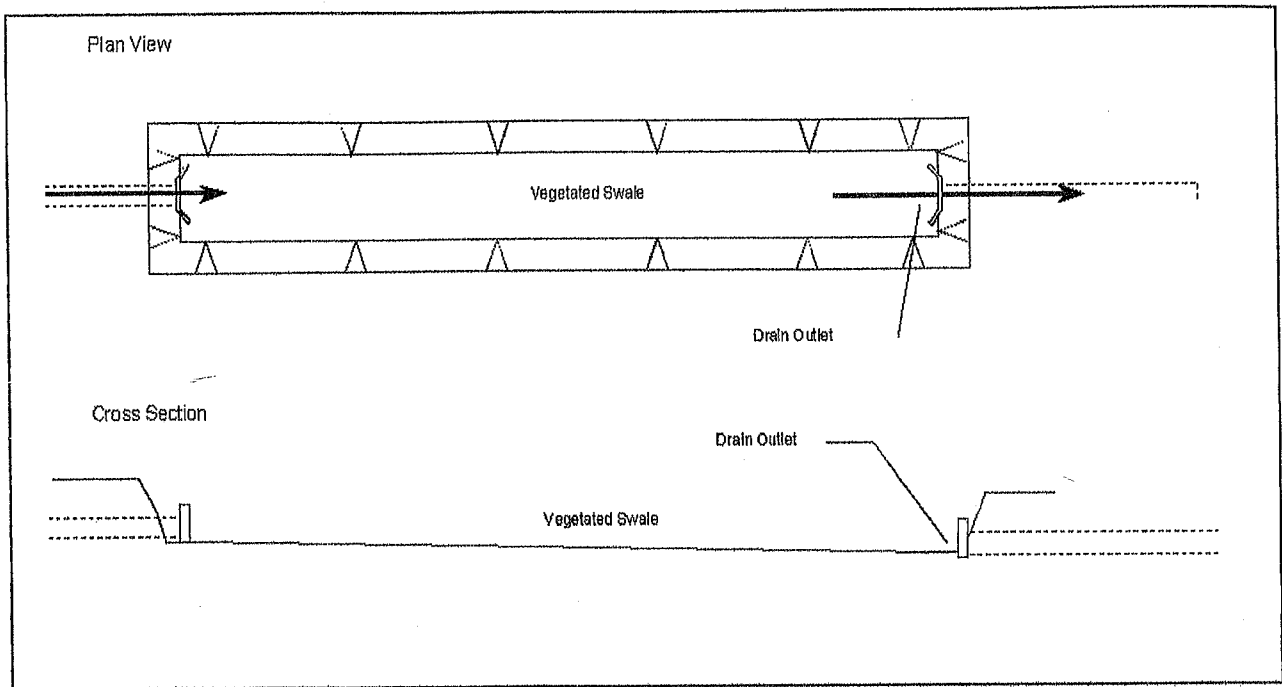


Figure 3.3.1
Example of Bio-filter Schematic

Table 3.3.1: Summary Of Bio-filtration Design Factors (Strips And Swales)

Description	Applications/Siting	Preliminary Design Factors
<p>Swales are vegetated channels that receive and convey storm water. Strips are vegetated buffer strips over which storm water flows as sheet flow.</p> <p>Treatment Mechanisms:</p> <ul style="list-style-type: none"> • Filtration through the grass • Sedimentation • Adsorption to soil particles • Infiltration <p>Pollutants removed:</p> <ul style="list-style-type: none"> • Debris and solid particles • Some dissolved constituents 	<ul style="list-style-type: none"> • Site conditions and climate allow vegetation to be established • • Flow velocities not high enough to cause scour 	<ul style="list-style-type: none"> • Swales sized as a conveyance system (per County flood routing and scour procedures) • Swales sized as a conveyance system (per County flood routing and scour procedures) • Swale water depth as shallow as the site will permit • Strips sized as long (in direction of flow) and flat as the site allows • Strips should be free of gullies or rills • No minimum dimensions or slope restrictions for treatment purposes • Vegetation mix appropriate for climates and location

5.0 OPERATION AND MAINTENANCE PROGRAM

The operation and maintenance requirements for each type of BMP is as follows:

5.1 Bio-Filters

The operational and maintenance needs of a Swale are:

- Vegetation management to maintain adequate hydraulic functioning and to limit habitat for disease-carrying animals.
- Animal and vector control.
- Periodic sediment removal to optimize performance.
- Trash, debris, grass trimmings, tree pruning, and leaf collection and removal to prevent obstruction of a Swale and monitoring equipment.
- Removal of standing water, which may contribute to the development of aquatic plant communities or mosquito breeding areas.
- Removal of graffiti.
- Preventive maintenance on sampling, flow measurement, and associated BMP equipment and structures.
- Erosion and structural maintenance to prevent the loss of soil and maintain the performance of the Swale.

Inspection Frequency

The facility will be inspected and inspection visits will be completely documented:

- Once a month at a minimum.
- After every large storm (after every storm monitored or those storms with more than 0.50 inch of precipitation.)
- On a weekly basis during extended periods of wet weather.

Aesthetic and Functional Maintenance

Aesthetic maintenance is important for public acceptance of stormwater facilities.

Functional maintenance is important for performance and safety reasons.

Both forms of maintenance will be combined into an overall Stormwater Management System Maintenance.

Aesthetic Maintenance

The following activities will be included in the aesthetic maintenance program:

- Graffiti Removal. Graffiti will be removed in a timely manner to improve the appearance of a Swale and to discourage additional graffiti or other acts of vandalism.
- Grass Trimming. Trimming of grass will be done on the Swale, around fences, at the inlet and outlet structures, and sampling structures.

- **Weed Control.** Weeds will be removed through mechanical means. Herbicide will not be used because these chemicals may impact the water quality monitoring.

Functional Maintenance

Functional maintenance has two components:

- Preventive maintenance
- Corrective maintenance

Preventive Maintenance

Preventive maintenance activities to be instituted at a Swale are:

- **Grass Mowing.** Vegetation seed mix within the Swale is designed to be kept short to maintain adequate hydraulic functioning and to limit the development of faunal habitats.
- **Trash and Debris.** During each inspection and maintenance visit to the site, debris and trash removal will be conducted to reduce the potential for inlet and outlet structures and other components from becoming clogged and inoperable during storm events.
- **Sediment Removal.** Sediment accumulation, as part of the operation and maintenance program at a Swale, will be monitored once a month during the dry season, after every large storm (0.50 inch), and monthly during the wet season. Specifically, if sediment reaches a level at or near plant height, or could interfere with flow or operation, the sediment will be removed. If accumulation of debris or sediment is determined to be the cause of decline in design performance, prompt action (i.e., within ten working days) will be taken to restore the Swale to design performance standards. Actions will include using additional fill and vegetation and/or removing accumulated sediment to correct channeling or ponding. Characterization and Appropriate disposal of sediment will comply with applicable local, county, state, or federal requirements. The swale will be regraded, if the flow gradient has changed, and then replanted with sod.
- **Removal of Standing Water.** Standing water must be removed if it contributes to the development of aquatic plant communities or mosquito breeding areas.
- **Mechanical and Electronic Components.** Regularly scheduled maintenance will be performed on fences, gates, locks, and sampling and monitoring equipment in accordance with the manufacturers' recommendations. Electronic and mechanical components will be operated during each maintenance inspection to assure continued performance.
- **Fertilization and Irrigation.** The vegetation seed mix has been designed so that fertilization and irrigation is not necessary. Fertilizers and irrigation will not be used to maintain the vegetation.
- **Elimination of Mosquito Breeding Habitats.** The most effective mosquito control program is one that eliminates potential breeding habitats.

Corrective Maintenance

Corrective maintenance is required on an emergency or non-routine basis to correct problems and to restore the intended operation and safe function of a Swale. Corrective maintenance activities include:

- **Removal of Debris and Sediment.** Sediment, debris, and trash, which impede the hydraulic functioning of a Swale and prevent vegetative growth, will be removed and properly disposed. Temporary arrangements will be made for handling the sediments until a permanent arrangement is made. Vegetation will be re-established after sediment removal.
- **Structural Repairs.** Once deemed necessary, repairs to structural components of a Swale and its inlet and outlet structures will be done within 10 working days. Qualified individuals (i.e., the designers or contractors) will conduct repairs where structural damage has occurred.
- **Embankment and Slope Repairs.** Once deemed necessary, damage to the embankments and slopes of Swales will be repaired within 10 working days).
- **Erosion Repair.** Where a reseeding program has been ineffective, or where other factors have created erosive conditions (i.e., pedestrian traffic, concentrated flow, etc.), corrective steps will be taken to prevent loss of soil and any subsequent danger to the performance of a Swale. There are a number of corrective actions than can be taken. These include erosion control blankets, riprap, sodding, or reduced flow through the area. Designers or contractors will be consulted to address erosion problems if the solution is not evident.
- **Fence Repair.** Repair of fences will be done within 30 days to maintain the security of the site.
- **Elimination of Animal Burrows.** Animal burrows will be filled and steps taken to remove the animals if burrowing problems continue to occur (filling and compacting). If the problem persists, vector control specialists will be consulted regarding removal steps. This consulting is necessary as the threat of rabies in some areas may necessitate the animals being destroyed rather than relocated. If the BMP performance is affected, abatement will begin. Otherwise, abatement will be performed annually in September.
- **General Facility Maintenance.** In addition to the above elements of corrective maintenance, general corrective maintenance will address the overall facility and its associated components. If corrective maintenance is being done to one component, other components will be inspected to see if maintenance is needed.

Debris and Sediment Disposal

Waste generated at Swales is ultimately the responsibility of the homeowners. Disposal of sediment, debris, and trash will comply with applicable local, county, state, and federal waste control programs. Table 3.1.2.1 shows a few possible disposal services for waste material.

Hazardous Waste

Suspected hazardous wastes will be analyzed to determine disposal options. Hazardous wastes generated onsite will be handled and disposed of according to applicable local,

state, and federal regulations. A solid or liquid waste is considered a hazardous waste if it exceeds the criteria listed in the CCR, Title 22, Article 11.

6.0 FISCAL RESOURCES

The County has developed categorical guidance for long-term BMP maintenance and resourcing.

Biofilter (Grass swale, Grass strip, vegetated buffer) are considered to be First Category BMPs

For First Category BMPs:

The County should have only minimal concern for ongoing maintenance. The proposed BMPs inherently "take care of themselves", or property owners can naturally be expected to do so as an incident of taking care of their property

Mechanisms to Assure Maintenance:

1. Stormwater Ordinance Requirement: The County of San Diego Watershed Protection, Stormwater Management, and Discharge Control Ordinance (S.O.) requires this ongoing maintenance. In the event that the mechanisms below prove ineffective, or in addition to enforcing those mechanisms, civil action, criminal action or administrative citation could also be pursued for violations of the ordinance.
2. Public Nuisance Abatement: Under the S.O. failure to maintain a BMP would constitute a public nuisance, which may be abated under the Uniform Public Nuisance Abatement Procedure. This provides an enforcement mechanism additional to the above, and would allow costs of maintenance to be billed to the owner, a lien placed on the property, and the tax collection process to be used.
3. Notice to Purchasers. Section 67.819(e) of the SO requires developers to provide clear written notification to persons acquiring land upon which a BMP is located, or others assuming a BMP maintenance obligation, of the maintenance duty.
4. Conditions in Ongoing Land Use Permits: For those applications (listed in SO Section 67.804) upon whose approval ongoing conditions may be imposed, a condition will be added which requires the owner of the land upon which the stormwater facility is located to maintain that facility in accordance with the requirements specified in the SMP. Failure to perform maintenance may then be addressed as a violation of the permit, under the ordinance governing that permit process.

5. Subdivision Public Report: Tentative Map and Tentative Parcel Map approvals will be conditioned to require that, prior to approval of a Final or Parcel Map, the subdivider shall provide evidence to the Director of Public Works, that the subdivider has requested the California Department of Real Estate to include in the public report to be issued for the sales of lots within the subdivision, a notification regarding the maintenance requirement. (The requirement for this condition would not be applicable to subdivisions which are exempt from regulation under the Subdivided Lands Act, or for which no public report will be issued.)

Funding:

No funding is required for maintenance.

Cost Estimate for Installation of Post Construction BMPs:

BMP Cost Estimate

TPM 20929
ER 05-02-011

Cole Grade Road

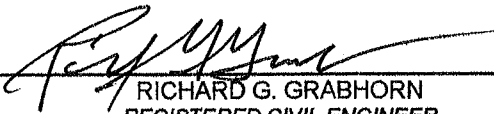
ITEM	DESCRIPTION	UNIT	PRICE	QUANTITY	COST
Bio Filter Swale	Average 10' wide Hydroseed and Irrigation				
Labor		Hours	\$50.00	80	\$4,000.00
Equipment		Hours	\$100.00	40.00	\$4,000.00
Materials		S.F.	\$0.24	16,450	\$3,948.00
SUBTOTAL					\$11,948.00
Rip-Rap	10' x 12' per D-40				
Labor		Hours	\$50.00	16	\$800.00
Equipment		Hours	\$100.00	8.00	\$800.00
Materials		C.Y.	\$50.00	15	\$750.00
SUBTOTAL					\$2,350.00
TOTAL					\$14,298.00

7.0 SUMMARY/CONCLUSIONS

This SWMP has been prepared in accordance with the Watershed Protection, Stormwater Management, and Discharge Control Ordinance and the Stormwater Standards Manual. This SWMP has evaluated and addressed the potential pollutants associated with this project and their effects on water quality. A summary of the facts and findings associated with this project and the measures addressed by this SWMP is as follows:

- The beneficial uses for the receiving waters have been identified. None of these beneficial uses will be impaired or diminish due to the construction and operation of this project.
- The project will not significantly alter drainage patterns on the site. The discharge points will not be changed and riprap energy dissipaters will be placed within the project to attenuate the flow velocities, thus preventing downstream erosion.
- The impervious area of the project will be increased by only 0.69 acres. Open areas and slopes will be landscaped to reduce or eliminate sediment discharge.
- The vegetated swales posed as part of the project will provide some storm water quality benefit by reducing the velocities, and providing opportunities for infiltration.
- The proposed construction and post-construction BMPs address mitigation measures to protect water quality and protection of water quality objectives and beneficial uses to the maximum extent practicable.

This Stormwater Management Plan has been prepared under the direction of the following Registered Civil Engineer. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.



RICHARD G. GRABHORN
REGISTERED CIVIL ENGINEER

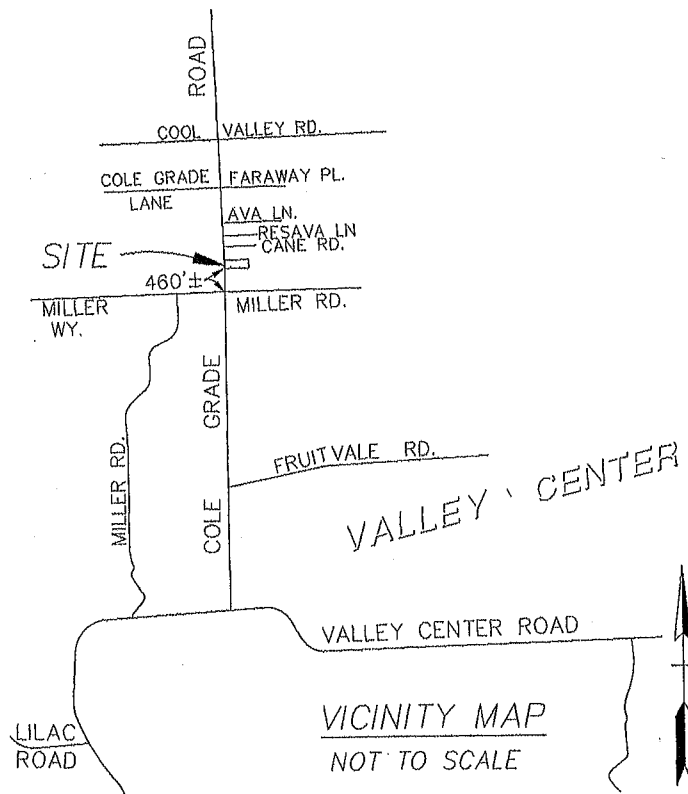
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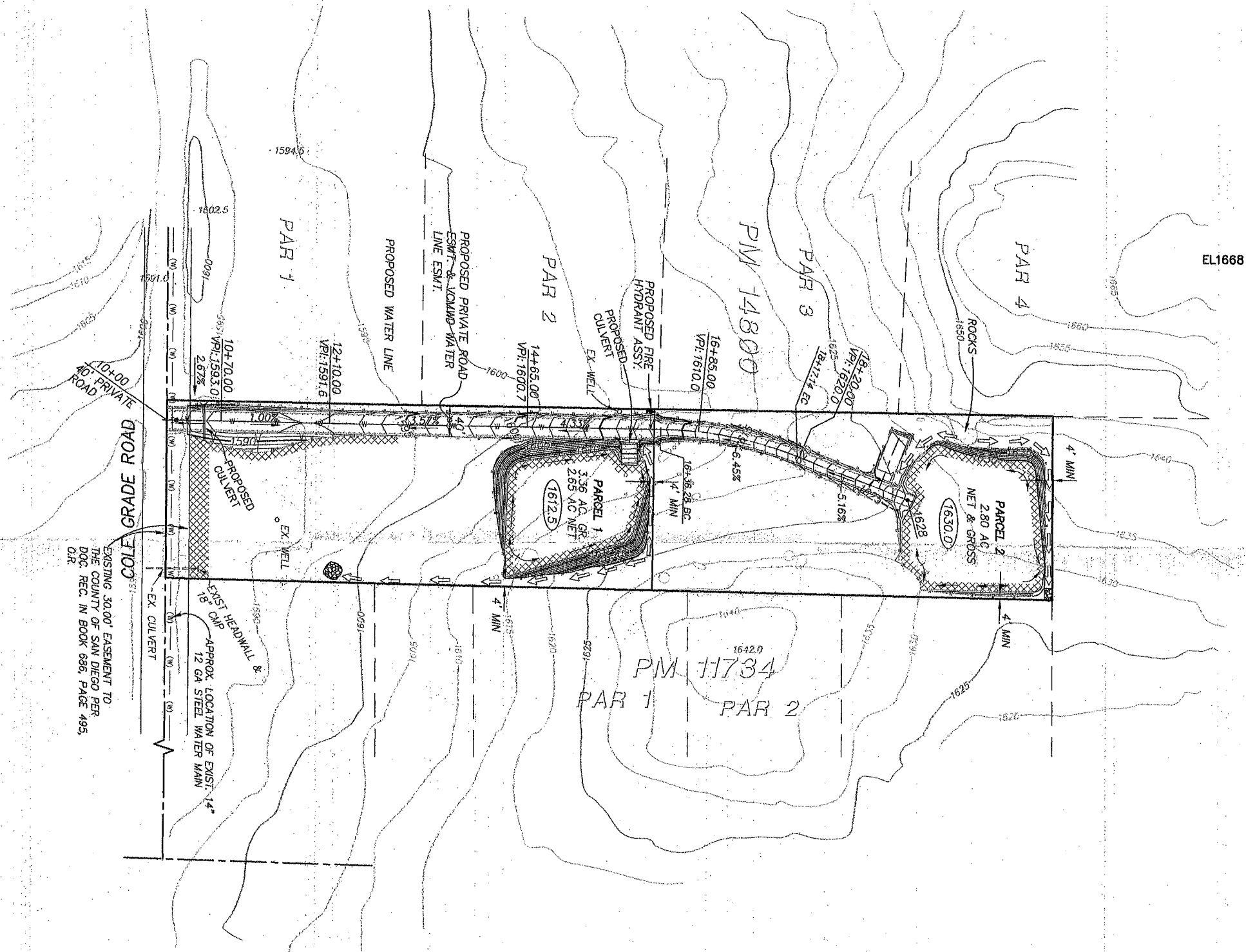
ATTACHMENT A

LOCATION MAP

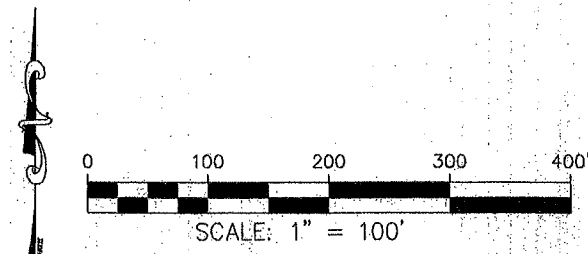


ATTACHMENT B

PROJECT MAP



- CONCRETE BROW DITCH D-75
- RIP-RAP D-40
- PROPOSED VEGETATIVE BIOFILTER
- PROPOSED SLOPE PLANTING SLOPE HEIGHT GREATER THAN 5'

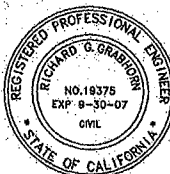


PROJECT MAP

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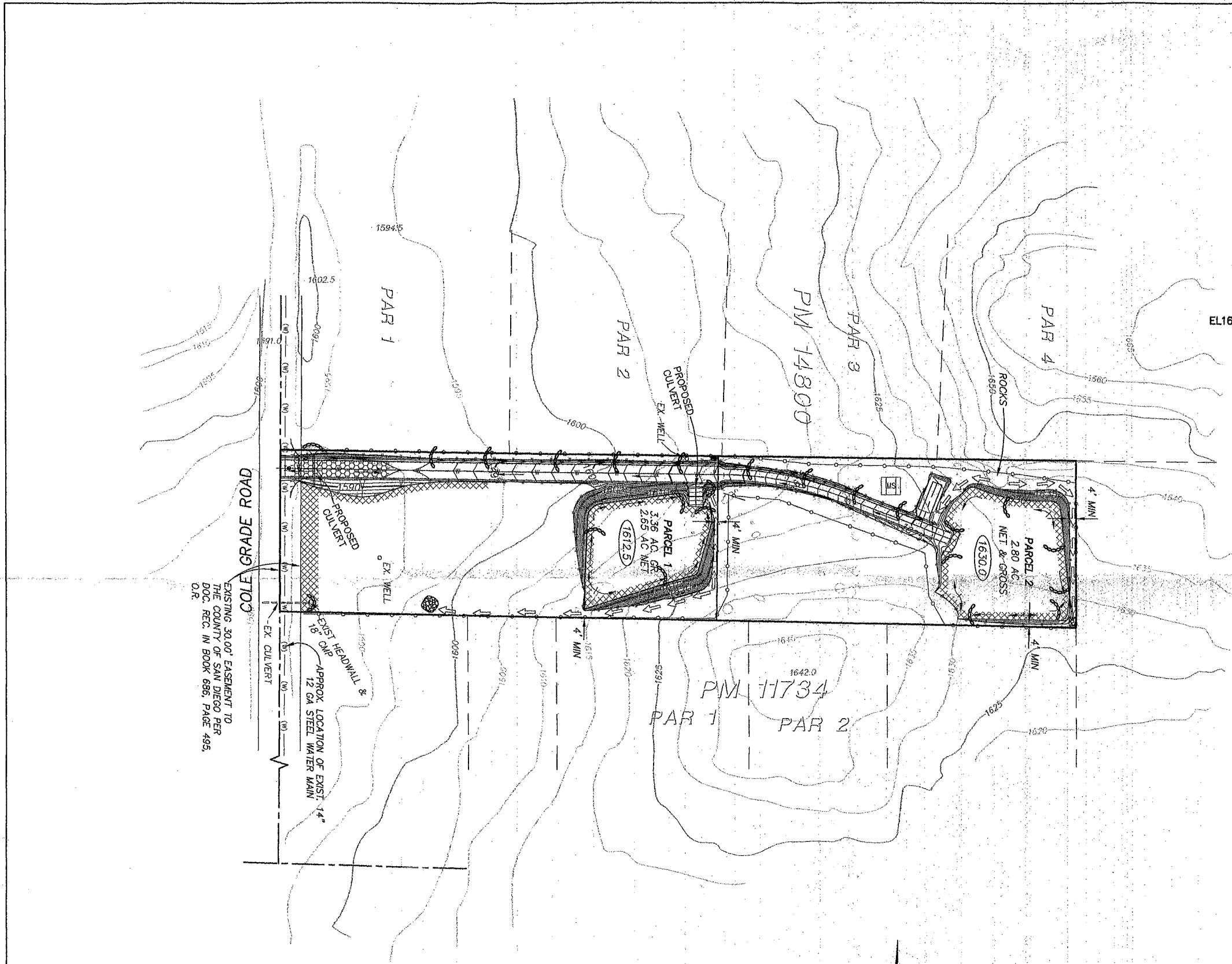
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ATTACHMENT C

BMP MAP



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LEGEND:

PROJECT BOUNDARY	---
PROPOSED LOT LINE	---
EXISTING CONTOUR	1635
PROPOSED CONTOUR	1625
EXISTING WATER	(W)
PROPOSED WATER	W
PROPOSED FIRE HYDRANT ASSY.	1615
PROPOSED PAD ELEVATION	1615
PROPOSED SLOPES	Y Y
DAYLIGHT LINE	---
DIRECTION OF DRAINAGE	→ →
CONCRETE BROW DITCH	D-75
RIP-RAP	D-40
PROPOSED PRIMARY LEACH LINE	---
PROPOSED RESERVE LEACH LINE	---

BEST MANAGEMENT PRACTICES

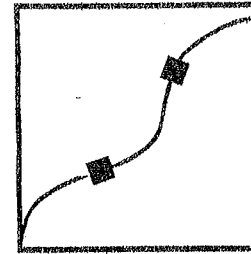
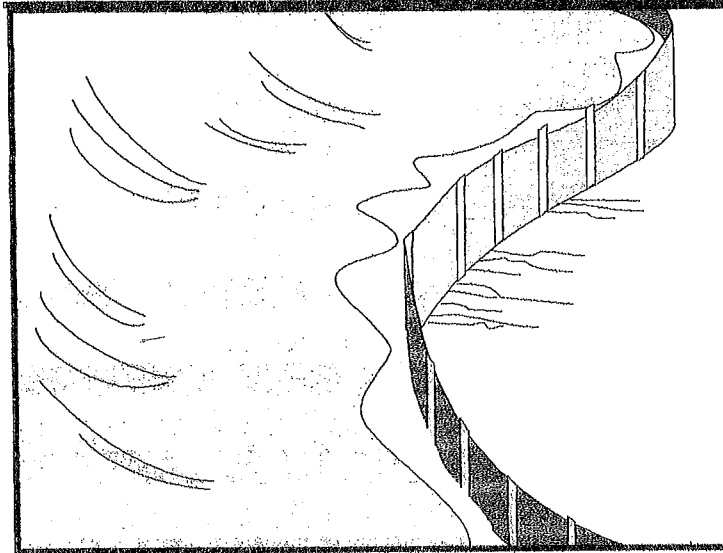
DESCRIPTION	
SC-1 SILT FENCE	---
SC-8 GRAVEL BAG BARRIER	○○○○
SS-9 DRAINAGE SWALE & LINED DITCHES	→ →
TC-1 STABILIZED CONSTRUCTION ENTRANCE	□□□□
WM-1 MATERIAL DELIVERY STORAGE	MS
PROPOSED VEGETATIVE BIOFILTER	▨
PROPOSED SLOPE PLANTING SLOPE HEIGHT GREATER THAN 5'	▨

BMP MAP

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ATTACHMENT D

BMP DATASHEETS



Standard Symbol

BMP Objectives

- ☐ Soil Stabilization
- ☒ Sediment Control
- ☐ Tracking Control
- ☐ Wind Erosion Control
- ☐ Non-Storm Water Management
- ☐ Materials and Waste Management

Definition and Purpose

A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences allow sediment to settle from runoff before water leaves the construction site.

Appropriate Applications

- Silt fences are placed:
- Below the toe of exposed and erodible slopes.
 - Down-slope of exposed soil areas.
 - Around temporary stockpiles.
 - Along streams and channels.
 - Along the perimeter of a project.

Limitations

- Not effective unless trenched and keyed in.
- Not intended for use as mid-slope protection on slopes greater than 1:4 (V:H).
- Must be maintained.
- Must be removed and disposed of.
- Don't use below slopes subject to creep, slumping, or landslides.
- Don't use in streams, channels, drain inlets, or anywhere flow is concentrated.
- Don't use silt fences to divert flow.

Standards and Specifications *Design and Layout*

- The maximum length of slope draining to any point along the silt fence shall be 61 m (200 ft) or less.
- Slope of area draining to silt fence shall be less than 1:1 (V:H).
- Limit to locations suitable for temporary ponding or deposition of sediment.
- Fabric life span generally limited to between five and eight months. Longer periods may require fabric replacement.
- Silt fences shall not be used in concentrated flow areas.
- Lay out in accordance with Pages 5 and 6 of this BMP.
- For slopes steeper than 1:2 (V:H) and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be a chain link fence or a cable fence.
- For slopes adjacent to water bodies or Environmentally Sensitive Areas (ESAs), additional temporary soil stabilization BMPs shall be used.

Materials

- Silt fence fabric shall be woven polypropylene with a minimum width of 900 mm (36 inches) and a minimum tensile strength of 0.45-kN. The fabric shall conform to the requirements in ASTM designation D4632 and shall have an integral reinforcement layer. The reinforcement layer shall be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric shall be between 0.1 sec^{-1} and 0.15 sec^{-1} in conformance with the requirements in ASTM designation D4491. Contractor must submit certificate of compliance in accordance with Standard Specifications Section 6-1.07.
- Wood stakes shall be commercial quality lumber of the size and shape shown on the plans. Each stake shall be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.
- Bar reinforcement may be used, and its size shall be equal to a number four (4) or greater. End protection shall be provided for any exposed bar reinforcement.
- Staples used to fasten the fence fabric to the stakes shall be not less than 45 mm (1.75 inches) long and shall be fabricated from 1.57 mm (0.06 inch) or heavier wire. The wire used to fasten the tops of the stakes together when

joining two sections of fence shall be 3.05 mm (0.12 inch) or heavier wire. Galvanizing of the fastening wire is not required.

Installation

- Generally, silt fences shall be used in conjunction with soil stabilization source controls up slope to provide effective erosion and sediment control.
- Bottom of the silt fence shall be keyed-in a minimum of 150 mm (12 inches).
- Trenches shall not be excavated wider and deeper than necessary for proper installation of the temporary linear sediment barriers.
- Excavation of the trenches shall be performed immediately before installation of the temporary linear sediment barriers.
- Construct silt fences with a set-back of at least 1m (3 ft) from the toe of a slope. Where a silt fence is determined to be not practical due to specific site conditions, the silt fence may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practical.
- Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case shall the reach exceed 150 meters (490 ft).
- Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
- Install in accordance with Pages 5 and 6 of this BMP.

Maintenance and Inspection

- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric.
- Inspect silt fence when rain is forecast. Perform necessary maintenance, or maintenance required by the Resident Engineer (RE).
- Inspect silt fence following rainfall events. Perform maintenance as necessary, or as required by the RE.
- Maintain silt fences to provide an adequate sediment holding capacity. Sediment shall be removed when the sediment accumulation reaches one-third (1/3) of the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the right-of-way in conformance with the Standard Specifications.
- Silt fences that are damaged and become unsuitable for the intended purpose, as determined by the RE, shall be removed from the site of work, disposed of outside the highway right-of-way in conformance with the Standard Specifications, and replaced with new silt fence barriers.

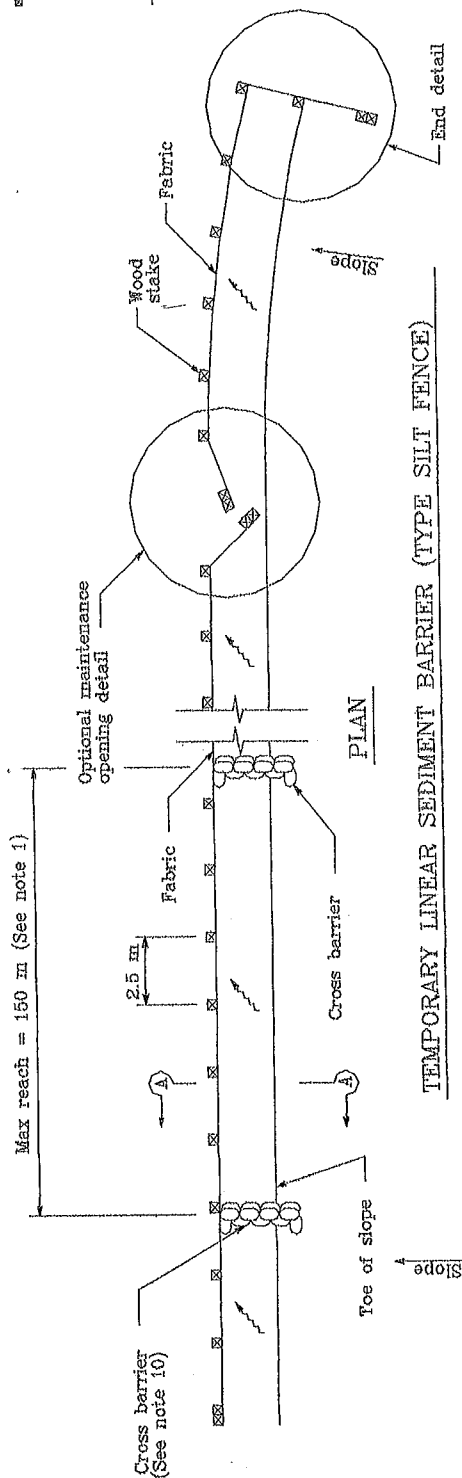


- Holes, depressions or other ground disturbance caused by the removal of the temporary silt fences shall be backfilled and repaired in conformance with the Standard Specifications.
- Remove silt fence when no longer needed or as required by the RE. Fill and compact post holes and anchorage trench, remove sediment accumulation, and grade fence alignment to blend with adjacent ground.



Silt Fence

SC-1



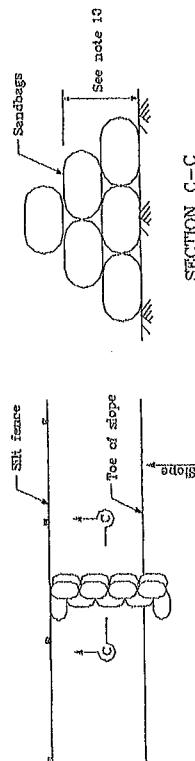
TEMPORARY LINEAR SEDIMENT BARRIER (TYPE SILT FENCE)

NOTES

- Construct the length of each reach so that the change in base elevation along the reach does not exceed $1/3$ the height of the linear barrier. In no case shall the reach length exceed 150m.
- The last 2.5 m of fence shall be turned up slope.
- Stake dimensions are nominal.
- Dimensions may vary to fit field condition.
- Stakes shall be spaced at 2.5 m maximum and shall be positioned on downstream side of fence.
- Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
- Stakes shall be driven tightly together to prevent potential flow-through of sediment at joint. The tops of the stakes shall be secured with wire.
- For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
- Minimum 4 staples per stake. Dimensions shown are typical.
- Cross barriers shall be a minimum of $1/3$ and a maximum of $1/2$ the height of the linear barrier.
- Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
- Joining sections shall not be placed at sump locations.
- Sandbag rows and layers shall be offset to eliminate gaps.

LEGEND

- Tampers backfill
- Slope direction
- Direction of flow



SECTION C-C

CROSS BARRIER DETAIL

TEMPORARY LINEAR SEDIMENT BARRIER (TYPE SILT FENCE)

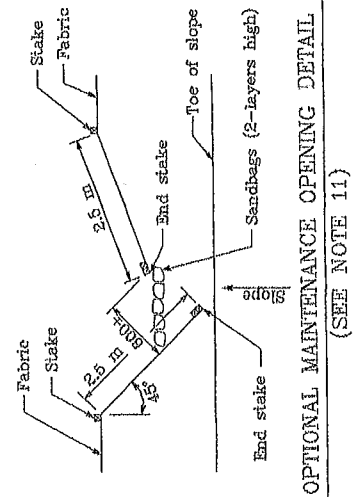
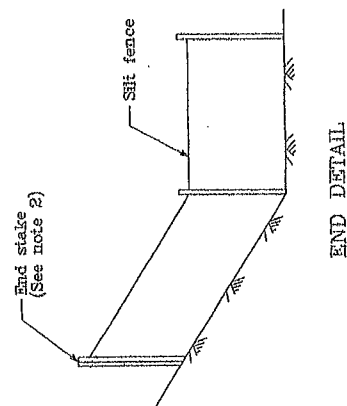
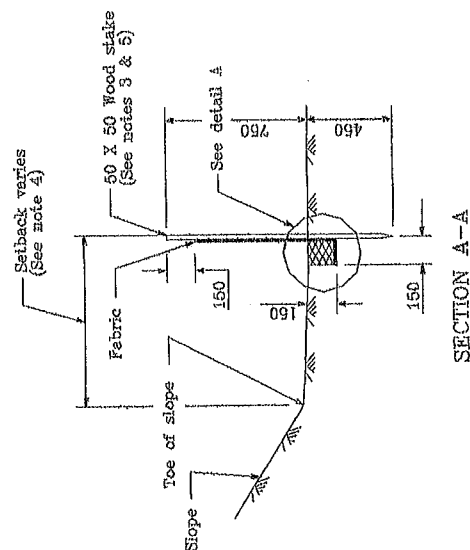
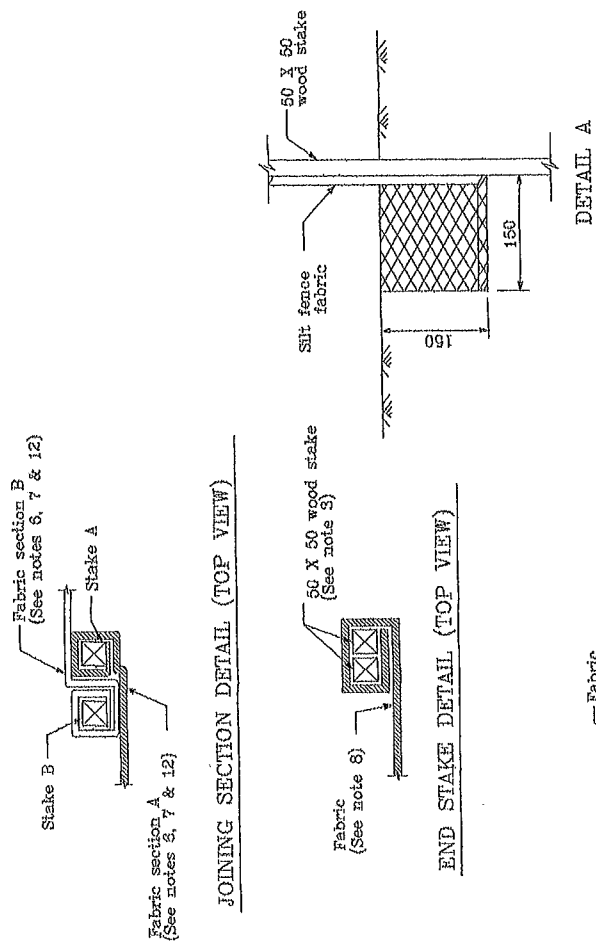
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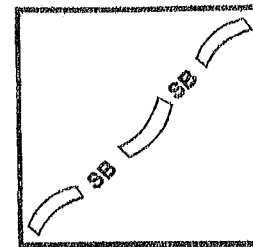
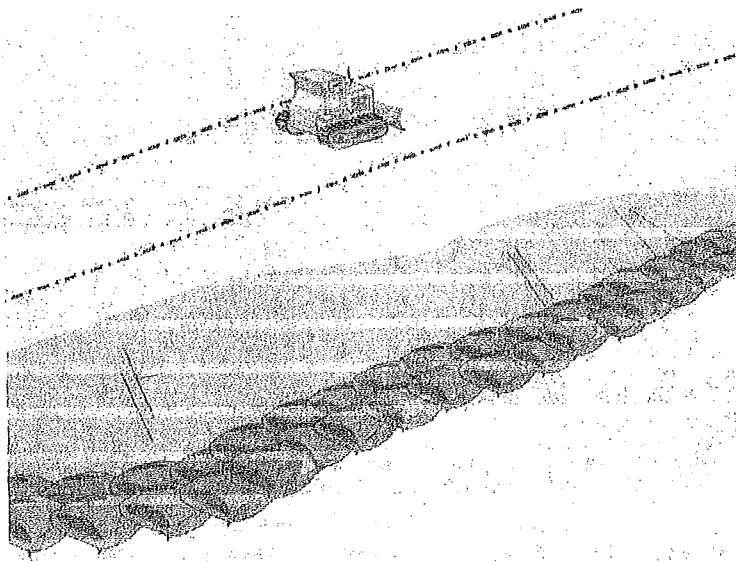
ALL DIMENSIONS ARE IN
MILLIMETERS UNLESS OTHERWISE SHOWN



Silt Fence

SC-1





Standard Symbol

BMP Objectives

- ☐ Soil Stabilization
- ☒ Sediment Control
- ☐ Tracking Control
- ☐ Wind Erosion Control
- ☐ Non-Storm Water Management
- ☐ Materials and Waste Management

Definition and Purpose

A sandbag barrier is a temporary linear sediment barrier consisting of stacked sandbags, designed to intercept and slow the flow of sediment-laden sheet flow runoff. Sandbag barriers allow sediment to settle from runoff before water leaves the construction site.

Appropriate Applications

- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Resident Engineer (RE).
- Along the perimeter of a site.
- Along streams and channels.
- Below the toe of exposed and erodible slopes.
- Down slope of exposed soil areas.
- Around stockpiles.
- Across channels to serve as a barrier for utility trenches or provide a temporary channel crossing for construction equipment, to reduce stream impacts.
- Parallel to a roadway to keep sediment off paved areas.
- At the top of slopes to divert roadway runoff away from disturbed slopes.
- To divert or direct flow or create a temporary sediment/desilting basin.
- During construction activities in stream beds when the contributing drainage area is less than 2 ha (5 ac).

- When extended construction period limits the use of either silt fences or straw bale barriers.
- Along the perimeter of vehicle and equipment fueling and maintenance areas or chemical storage areas.
- To capture and detain non-storm water flows until proper cleaning operations occur.
- When site conditions or construction sequencing require adjustments or relocation of the barrier to meet changing field conditions and needs during construction.
- To temporarily close or continue broken, damaged or incomplete curbs.

Limitations

- Limit the drainage area upstream of the barrier to 2 ha (5 ac).
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.

Standards and Specifications

Materials

- Sandbag Material: Sandbag shall be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight 135 g/m² (four ounces per square yard), mullen burst strength exceeding 2,070 kPa (300 psi) in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap is not acceptable.
- Sandbag Size: Each sand-filled bag shall have a length of 450 mm (18 in), width of 300 mm (12 in), thickness of 75 mm (3 in), and mass of approximately 15 kg (33 lb.). Bag dimensions are nominal, and may vary based on locally available materials. Alternative bag sizes shall be submitted to the RE for approval prior to deployment.
- Fill Material: All sandbag fill material shall be non-cohesive, Class 1 or Class 2 permeable material free from clay and deleterious material, conforming to the provisions in Standard Specifications Section 68-1.025 "Permeable Material". The requirements for the Durability Index and Sand Equivalent do not apply. Fill material is subject to approval by the RE.

Installation

- When used as a linear sediment control:
 - Install along a level contour.
 - Turn ends of sandbag row up slope to prevent flow around the ends.
 - Generally, sandbag barriers shall be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.
 - Install as shown in Pages 4 and 5 of this BMP.
- Construct sandbag barriers with a set-back of at least 1m (3 ft) from the toe of a slope. Where it is determined to be not practical due to specific site conditions, the sandbag barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.

Maintenance and Inspection

- Inspect sandbag barriers before and after each rainfall event, and weekly throughout the rainy season.
- Reshape or replace sandbags as needed, or as directed by the RE.
- Repair washouts or other damages as needed, or as directed by the RE.
- Inspect sandbag barriers for sediment accumulations and remove sediments when accumulation reaches one-third the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.
- Remove sandbags when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

SC-8



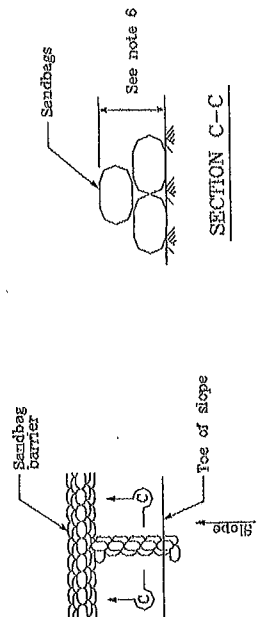
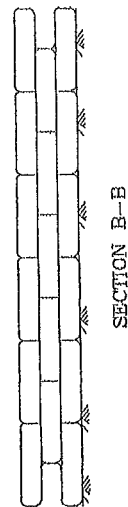
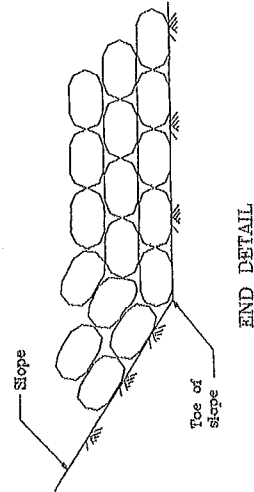
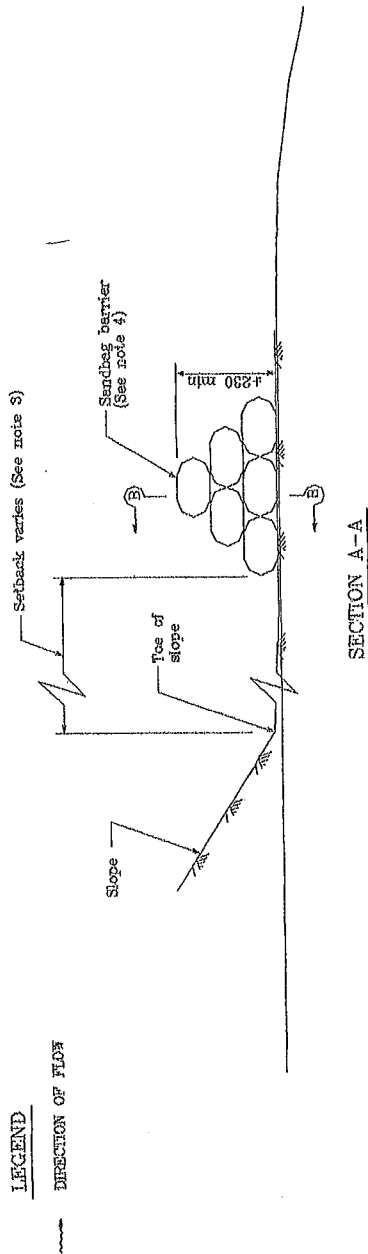
ALL DIMENSIONS ARE IN
MILLIMETERS UNLESS OTHERWISE SHOWN

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed $1/2$ the height of the linear barrier. In no case shall the reach length exceed 150 m.

2. Place sandbags tightly.
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of $1/2$ and a max of $2/3$ the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.

Sandbag Barrier

SC-8



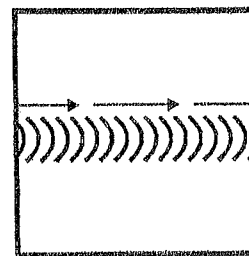
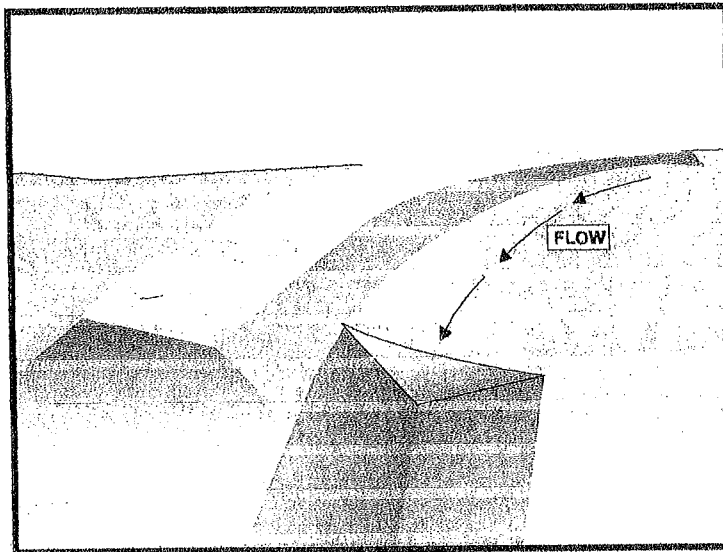
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
TEMPORARY LINEAR SEDIMENT BARRIER
(TYPE SANDBAG)

NO SCALE
ALL DIMENSIONS ARE IN
MILLIMETERS UNLESS OTHERWISE SHOWN



Earth Dikes/Drainage Swales and Lined Ditches

SS-9



Standard Symbol

BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

These are structures that intercept, divert and convey surface run-on, generally sheet flow, to prevent erosion.

Appropriate Applications

- Earth dikes/drainage swales and lined ditches may be used to:
 - Convey surface runoff down sloping land.
 - Intercept and divert runoff to avoid sheet flow over sloped surfaces.
 - Divert and direct runoff towards a stabilized watercourse, drainage pipe or channel.
 - Intercept runoff from paved surfaces.
- Earth dikes/drainage swales and lined ditches also may be used:
 - Below steep grades where runoff begins to concentrate.
 - Along roadways and facility improvements subject to flood drainage.
 - At the top of slopes to divert run-on from adjacent or undisturbed slopes.
 - At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the Resident Engineer (RE).



Earth Dikes/Drainage Swales and Lined Ditches

SS-9

Limitations ■ Earth dikes/drainage swales and lined ditches are not suitable as sediment trapping devices.

- May be necessary to use other soil stabilization and sediment controls, such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales and ditches.

**Standards and
Specifications**

- Care must be applied to correctly size and locate earth dikes, drainage swales and lined ditches. Excessively steep, unlined dikes and swales are subject to erosion and gully formation.
- Conveyances shall be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, over topping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff from the highway right-of-way onto other property.
- When possible, install and utilize permanent dikes, swales and ditches early in the construction process.
- Provide stabilized outlets. Refer to SS-10, "Outlet Protection/Velocity/Dissipation Devices."

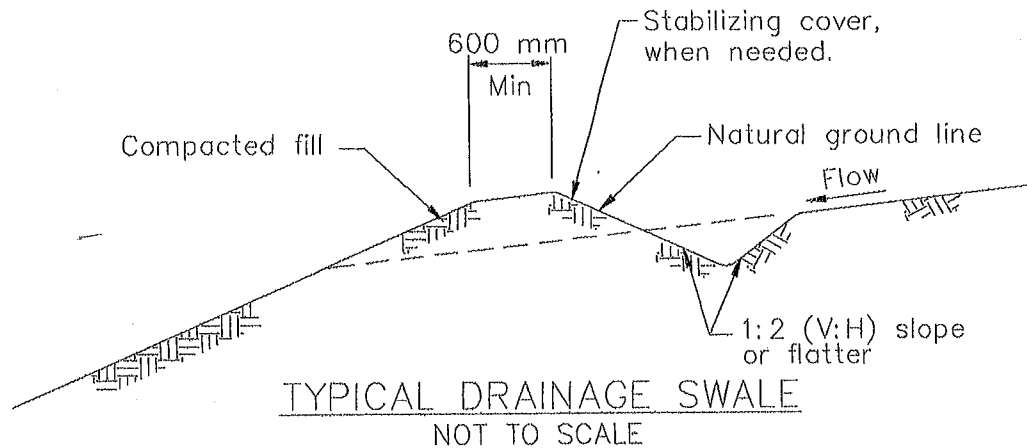
**Maintenance and
Inspections**

- Inspect temporary measures prior to the rainy season, after rainfall events, and regularly (approximately once per week) during the rainy season.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment, and repair linings and embankments as needed or as directed by the RE.
- Temporary conveyances shall be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.



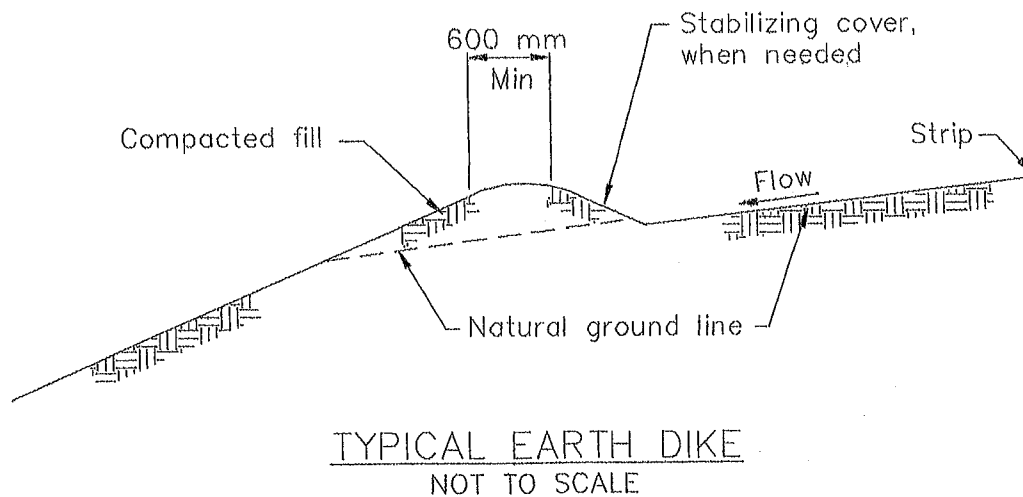
Earth Dikes/Drainage Swales and Lined Ditches

SS-9

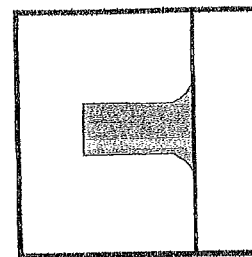
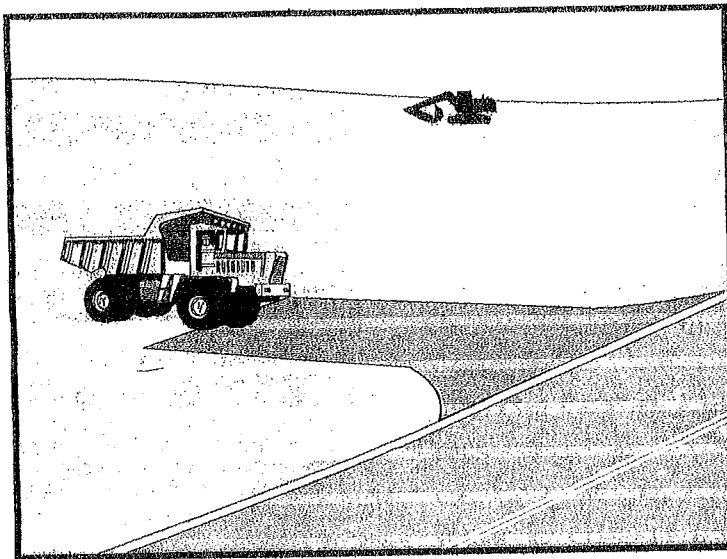


NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade, in conformance with Section 19-5 of the Caltrans Standard Specifications.



Stabilized Construction Entrance/Exit

TC-1

Standard Symbol

BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Appropriate Applications

- Use at construction sites:
 - Where dirt or mud can be tracked onto public roads.
 - Adjacent to water bodies.
 - Where poor soils are encountered.
 - Where dust is a problem during dry weather conditions.
 - This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the Resident Engineer (RE).
- ## Limitations
- Site conditions will dictate design and need.
- ## Standards and Specifications
- Limit the points of entrance/exit to the construction site.
 - Limit speed of vehicles to control dust.
 - Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
 - Route runoff from stabilized entrances/exits through a sediment-trapping device before discharge.
 - Design stabilized entrance/exit to support the heaviest vehicles and equipment that will use it.



Stabilized Construction Entrance/Exit **TC-1**

- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. The use of asphalt concrete (AC) grindings for stabilized construction access/roadway is not allowed.
- Use of constructed/manufactured steel plates with ribs for entrance/exit access is allowed with written approval from the RE.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 300 mm (12 in) depth, or place aggregate to a depth recommended by the RE. Crushed aggregate greater than 75 mm (3 inches) and smaller than 150 mm (6 inches) shall be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Implement BMP SC-7, "Street Sweeping and Vacuuming" as needed and as required.
- Require all employees, subcontractors, and suppliers to utilize the stabilized construction access.
- All exit locations intended to be used continuously and for a period of time shall have stabilized construction entrance/exit BMPs (TC-1 "Stabilized Construction Entrance/Exit" or TC-3 "Entrance/Outlet Tire Wash").

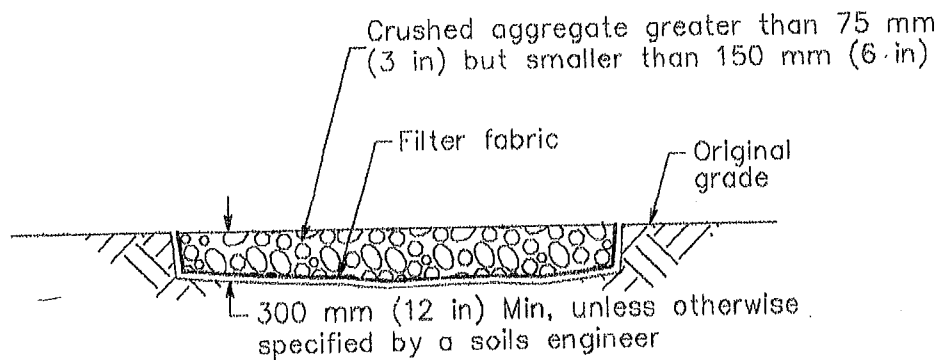
Maintenance and Inspection

- Inspect routinely for damage and assess effectiveness of the BMP. Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment or as directed by the RE.
- Keep all temporary roadway ditches clear.
- Inspect for damage and repair as needed.

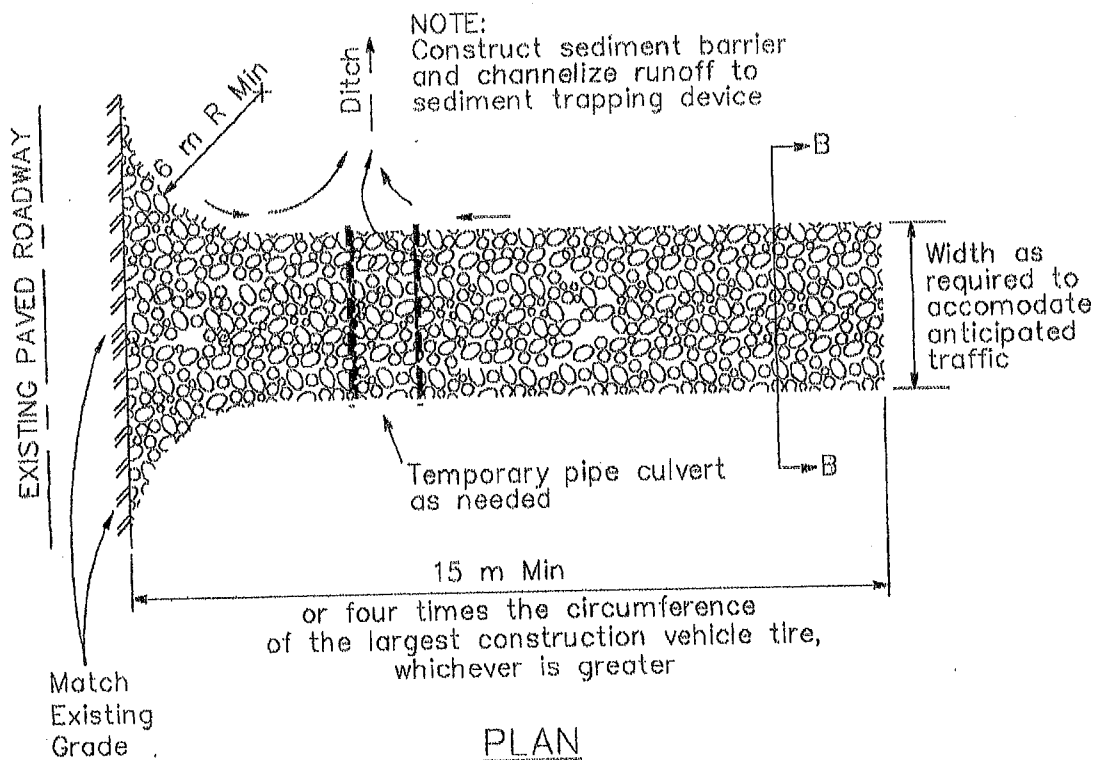


Stabilized Construction Entrance/Exit

TC-1



SECTION B-B
NTS

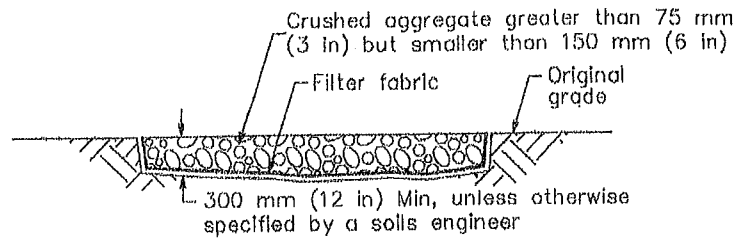


Stabilized Construction Entrance/Exit (Type 1)

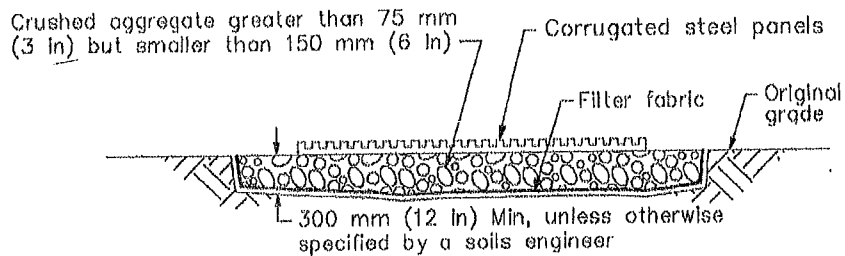


Stabilized Construction Entrance/Exit

TC-1



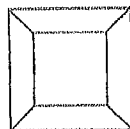
SECTION B-B
NTS



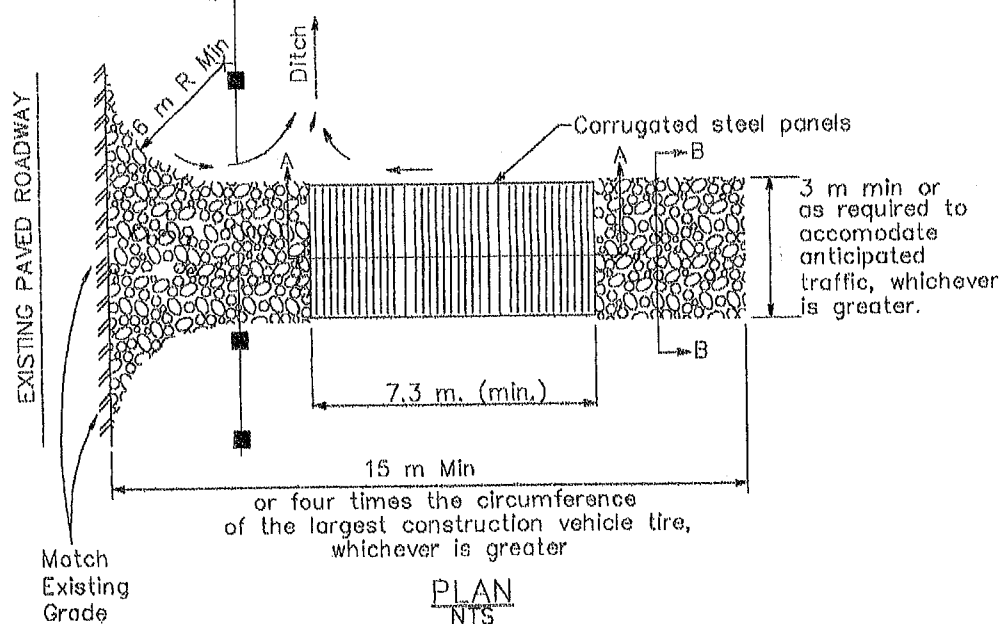
SECTION A-A
NOT TO SCALE

NOTE:

Construct sediment barrier and channelize runoff to sediment trapping device

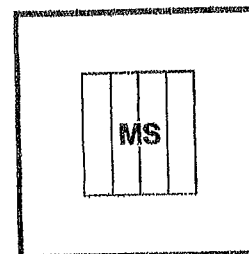
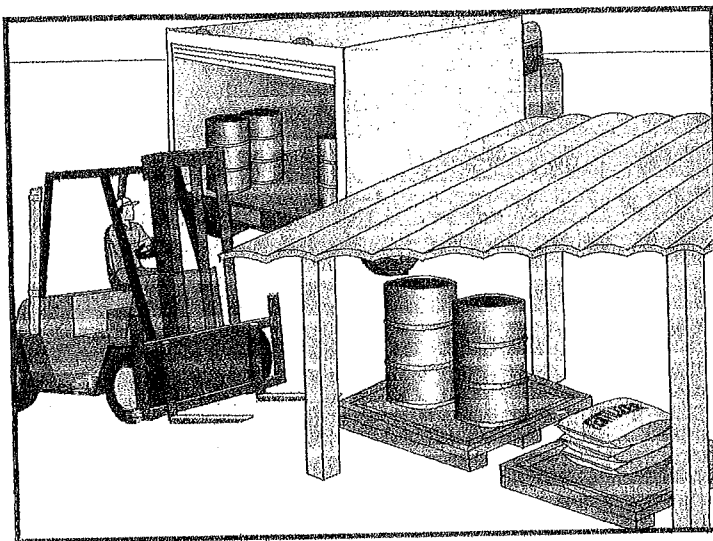


Sediment trapping device



Stabilized Construction Entrance/Exit (Type 2)





Standard Symbol

BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water Management
- Materials and Waste Management

Definition and Purpose

Procedures and practices for the proper handling and storage of materials in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or to watercourses.

Appropriate Applications

These procedures are implemented at all construction sites with delivery and storage of the following:

- Hazardous chemicals such as:
 - Acids,
 - lime,
 - glues,
 - adhesives,
 - paints,
 - solvents, and
 - curing compounds.
- Soil stabilizers and binders.
- Fertilizers.
- Detergents.
- Plaster.
- Petroleum products such as fuel, oil, and grease.
- Asphalt and concrete components.
- Pesticides and herbicides.

- Other materials that may be detrimental if released to the environment.

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds must meet building & fire code requirements.

Standards and Specifications

General

- Train employees and subcontractors on the proper material delivery and storage practices.
- Temporary storage area shall be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) shall be supplied to the Resident Engineer (RE) for all materials stored.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall be placed in temporary containment facilities for storage.
- Throughout the rainy season, each temporary containment facility shall have a permanent cover and side wind protection or be covered during non-working days and prior to and during rain events.
- A temporary containment facility shall provide for a spill containment volume able to contain precipitation from a 24-hour, 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids shall be sent to an approved disposal site.
- Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
- Materials shall be stored in their original containers and the original product labels shall be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced immediately.



- Bagged and boxed materials shall be stored on pallets and shall not be allowed to accumulate on the ground. To provide protection from wind and rain, throughout the rainy season, bagged and boxed materials shall be covered during non-working days and prior to rain events.
- Stockpiles shall be protected in accordance with BMP WM-3, "Stockpile Management."
- Minimize the material inventory stored on-site (e.g., only a few days supply).
- Have proper storage instructions posted at all times in an open and conspicuous location.
- Do not store hazardous chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and when possible, under cover in secondary containment.
- Keep hazardous chemicals well labeled and in their original containers.
- Keep ample supply of appropriate spill clean up material near storage areas.
- Also see BMP WM-6, "Hazardous Waste Management", for storing of hazardous materials.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored on-site.
- Employees trained in emergency spill clean-up procedures shall be present when dangerous materials or liquid chemicals are unloaded.

Spill Clean-up

- Contain and clean up any spill immediately.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose any hazardous materials or contaminated soil.
- See BMP WM-4, "Spill Prevention and Control", for spills of chemicals and/or hazardous materials.

Material Delivery and Storage

WM-1

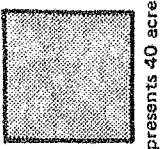
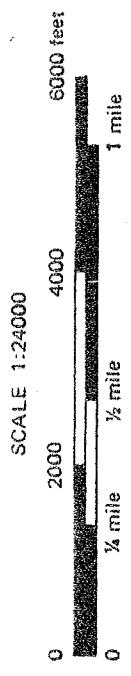
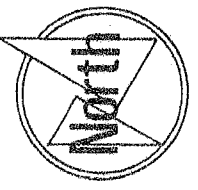
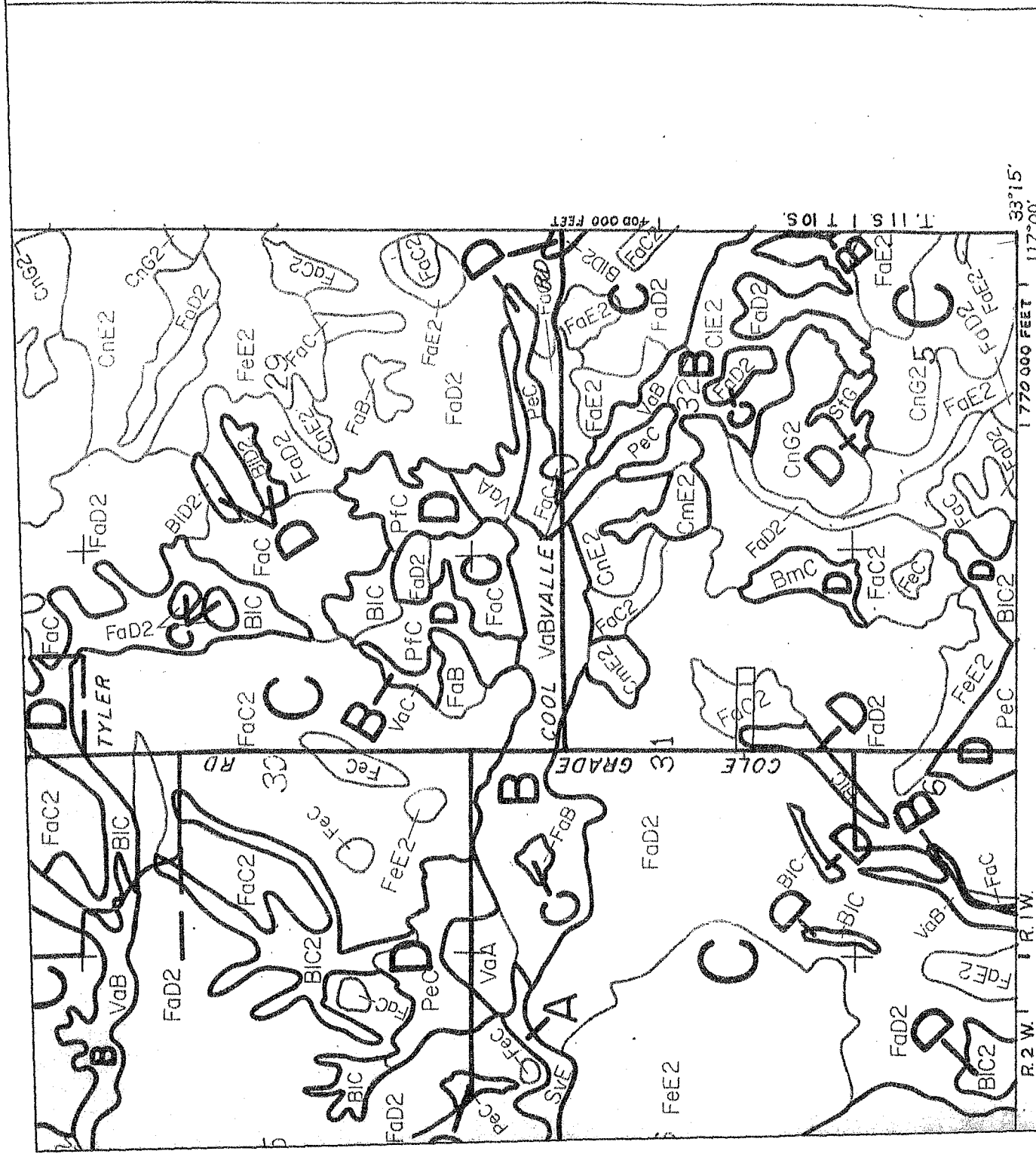
Maintenance and Inspection

- Storage areas shall be kept clean, well organized, and equipped with ample clean-up supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.
- Inspect storage areas before and after rainfall events, and at least weekly during other times. Collect and place into drums any spills or accumulated rainwater.



ATTACHMENT E

HYDROLOGIC SOIL GROUPS



FEDERAL ASSISTANCE - The preparation of this map was financed in part through a comprehensive planning grant from the Department of Housing and Urban Development.

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SHEET for assumptions,
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